Technical Report

Technical Report ID: NP_2023_123

Client: Ønsk Aps

Product: El Palto, Mørk ristet

Product detail: Coffee from El Palto cooperative in Peru, roasted in Denmark

The following material constitutes a technical report in the format requested by the ISO 14040/14044 and Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard.

Product description

- *El Palto coffee* (Arabica (Castillo, Catimor, Bourbon, Marselles)) was produced on hundreds of small-scale coffee farms in the middle of the Amazon rainforest in Peru that have come together in the cooperative *Jumarp*.
- Harvested coffee was depulped, washed, and transported to *Ecotierra Coffee* to be dried, sorted, screened, and packaged in 69 kg bags.
- The coffee product was transported to Denmark via sea transport, stored and roasted weekly, followed by packaging into 5 kg barrel. The bulk package was then transported to *Ønsk,* and some portions were further packaged into 1 kg and 0.25 kg bags and stored at the *Ønsk warehouse*.

Introduction

Estimating the environmental impact of a product requires a careful assessment of the supply chains linked to the product. A supply chain is a system of interlinked activities that contribute to one or more specified and intrinsically linked products. A better understanding of supply chains is increasingly being used in relation to transparency, as customers wish to know the exact origin of a product.

Life cycle assessment (LCA) is an internationally standardized tool that can be used to perform a holistic product specific environmental assessment. LCA is used to assess the environmental impact associated with all activities and product flows in a supply chain. Therefore, LCA is not merely used to estimate and report the environmental impact of a product but to identify hotspots (i.e., activities that have a high contribution to the total environmental impact) along the supply chain. Identification of these hotspots allows manufacturers to address these activities and identify strategies to improve the environmental performance of the product. LCA is widely used in all agricultural and industrial sectors to assess, report, and improve the environmental performance of the products. An important step in LCA modelling is mapping the supply chain and collecting the data associated with the product flows from each activity linked in the supply chain.

Goal of the study

Environmental footprint of agriculture

The study was performed to assess the environmental footprint of **Coffee, El Palto** produced in **Peru** and processed in **Denmark** by **Ønsk ApS** from the **Farm** to the **Warehouse**.

Anthropogenic climate change such as agriculture has significant impact on the physical environment and the ecosystems both directly and indirectly. However, climate change is only a part of the environmental impacts associated with agriculture; Agriculture is also the main driver for antibiotic resistance, water scarcity, eutrophication, biodiversity loss from pesticide usage and habitat destruction. This also means that the environmental footprint may fluctuate depending on what farming practices have been performed. Therefore, the focus of the study is to assess the environmental footprint, especially carbon footprint (climate change or GWP (Global Warming Potential)). This focus is chosen without any ranking of the importance of climate change relative to any other of the negative externalities associated with agriculture.

Attributional life cycle assessment

The study is based on the attributional life cycle analysis (a-LCA). This means that all significant activities and their emissions in the production are considered, and their combined impact is attributed to the product. The attributional approach only accounts for emissions and removals of greenhouse gases (GHGs) generated during a product's life cycle and not avoided emissions or actions taken to mitigate released emissions such as agroforestry. This contrasts to the consequential approach (c-LCA), which is used to assess the climate impact from changing the level of output of a product and focuses on marginal effects linked to the production of a product.

Stakeholders

The study has been carried out by **Nature Preserve**. Target audience is the users of the **Nature Preserve** online web application tool and their customers and clients.

Scope of the study

Unit of analysis

The unit of the analysis in this study is **one kilogram (kg)** of **Coffee, El Palto**.

System boundaries

The environmental footprint of **Coffee, El Palto**, is assessed from the farm to the warehouse. This study includes all steps of the life cycle from the production of agricultural inputs, through agricultural processes, machine use, post-harvest activities, any subsequent processing, packaging, and transportation up until the warehouse. Hence, the calculated environmental footprint does not consider extra miles from the warehouse to clients or end consumers.

Mechanisms included

All mechanisms that are generally considered within the system boundary are listed in this section. However, only mechanisms relevant to **Coffee, El Palto,** are applicable in this study.

Transportation and distribution mechanisms

- CH_4 emissions from rice cultivation
- CO_2 emissions from deforestation
- CO_2 emissions from drying of cereals, pulses and other crops typically dried at the farm
- CO_2 emissions from energy production for irrigation
- CO_2 emissions from liming
- CO_2 emissions from organic soils
- CO_2 emissions from pesticide production
- CO_2 emissions from production of fertilizers
- CO_2 emissions from urea fertilization
- CO_2 emissions from use of farm equipment
- N_2O emissions from managed soils (direct and indirect)
- N_2O emissions from organic soils
- N_2O emissions from production of fertilizers

Transportation and distribution mechanisms

- Emissions from extraction, production, transportation, and combustion of fuels
- Fuel consumption for all transportation stages within the system boundary of the study, such as transportation and distribution:
    - from farms to food processing factories
    - between factories
    - to warehouses
- The following aspects of transport are considered:
    - distance
    - temperature controlled transportation
    - leakage of refrigerant for temperature-controlled transportation
    - fuel consumption as a function of capacity utilization of the vehicles
    - empty returns of vehicles during distribution

- The high-altitude climate effects of aviation

Food processing mechanisms

- Direct emissions of fossil carbon or other greenhouse gases from ingredient reactions
- Energy consumption for food processing
- Food waste during production
- Leakage of refrigerants
- Waste treatment

Packaging mechanisms

- Extraction of raw materials
- Production of raw materials
- Production of packaging from raw materials
- Recycling of packaging
- Transportation of packaging

Mechanisms excluded

Mechanisms explicitly excluded as out-of-scope:

- Maintenance of farm equipment
- Commute of personnel to and from the farms
- Housing of personnel working at the farms
- Albedo changes due to the production of crops
- Corporate activities and services (e.g., research and development, administrative functions, company sales and marketing)

Mechanisms excluded unless it is expected to have significant impact on the result of the study:

- Manufacture of capital goods (e.g., machinery, trucks, infrastructure)

Time period

The assessment reflects the production of **Coffee, El Palto** in year **2023**. Agricultural production data averages the most recent 5-year period. For other agricultural input data, the latest available is used. Process data for the production of **Coffee, El Palto,** is from the most recent full year, but older data can be used when deemed reasonably representative and newer data cannot be obtained.

Carbon storage in products

Biogenic uptake of carbon stored in agricultural products is not considered since the carbon is released again upon digestion, decomposition, or incineration. Delay of emissions has not been taken into consideration due to the short time scales involved.

Environmental footprint indicators

Impact category / Indicator	Unit	Description
Climate change – total, fossil, biogenic and land use	kg CO_2-eq	Indicator of potential global warming due to emissions of greenhouse gases to the air. Divided into 3 subcategories based on the emission source: (1) fossil resources, (2) bio-based resources and (3) land use change.
Ozone depletion	kg CFC-11-eq	Indicator of emissions to air that causes the destruction of the stratospheric ozone layer
Acidification	kg mol H+	Indicator of the potential acidification of soils and water due to the release of gases such as nitrogen oxides and sulfur oxides
Eutrophication – freshwater	kg PO_4-eq	indicator of the enrichment of the freshwater ecosystem with nutritional elements, due to the emission of nitrogen or phosphor-containing compounds
Eutrophication – marine	Kg N-eq	Indicator of the enrichment of the marine ecosystem with nutritional elements, due to the emission of nitrogen-containing compounds.
Eutrophication – terrestrial	mol N-eq	Indicator of the enrichment of the terrestrial ecosystem with nutritional elements, due to the emission of nitrogen-containing compounds.
Photochemical ozone formation	kg NMVOC-eq	Indicators of emissions of gases that affect the creation of photochemical ozone in the lower atmosphere (smog) catalyzed by sunlight.
Depletion of abiotic resources – minerals and metals	kg Sb-eq	Indicator of the depletion of natural non-fossil resources.
Depletion of abiotic resources – fossil fuels	MJ, net calorific value	Indicator of the depletion of natural fossil fuel resources.
Human toxicity – cancer, non-cancer	CTUh	Impact on humans of toxic substances emitted to the environment. Divided into non-cancer and cancer-related toxic substances.
Eco-toxicity (freshwater)	CTUe	Impact on freshwater organisms of toxic substances emitted to the environment.
Water use	m3 world eq. deprived	Indicator of the relative amount of water used, based on regionalized water scarcity factors.

Land use	Dimensionless	Measure of the changes in soil quality (Biotic production, Erosion resistance, Mechanical filtration).
Ionizing radiation, human health	kBq U-235	Damage to human health and ecosystems linked to the emissions of radionuclides.
Particulate matter emissions	Disease incidence	Indicator of the potential incidence of disease due to particulate matter emissions

Allocation

When an agricultural activity generates more than one product, the climate impact from the activity needs to be allocated between the products. Allocation (instead of system expansion) is part of the traditional attributional approach to life cycle assessment. Allocation can be based on physical characteristics of the co-products such as mass or energy content or based on their relative market values (economic allocation). As a general principle in this study, economic allocation is applied. This means that the environmental footprint from agriculture is allocated between the products in proportion to their economic value.

If the economic value of by-products is unknown, it is conservatively assumed that they have no economic value, so that the whole climate impact is allocated to the main product.

Models and data

The climate footprint of **Coffee, El Palto** produced in **Peru** is calculated with the Nature Preserve calculation model. This is a model of farm level emissions based on the IPCC guidelines for national greenhouse gas inventories (IPCC, 2019), complemented with estimates of emissions due to production of inputs.

Land use change

The land use change (LUC) calculation is based on the PAS2050 framework, on the most recent FAO country-level data on cropland, forest, and grassland expansion and contraction. The basic methodology of this framework is now widely referenced and applied. allocate it among products through a land-balance model based mainly on FAOSTAT data for expansion of cropland, pastures and forest plantations.

Activity data

The input to the agricultural model is taken from a combination of **User's input** and **database of activity estimates** established with representativeness as main goal. Estimates of fertilizer inputs are made from FAO and IFA database on total fertilizer use within a country and/or crop group and attributing that to different crops in proportion to their nitrogen needs (modeled by using a mix of allometric data and specific factors such as nitrogen fixating mechanisms combined with production data).

Figure 1. Supply chain diagram

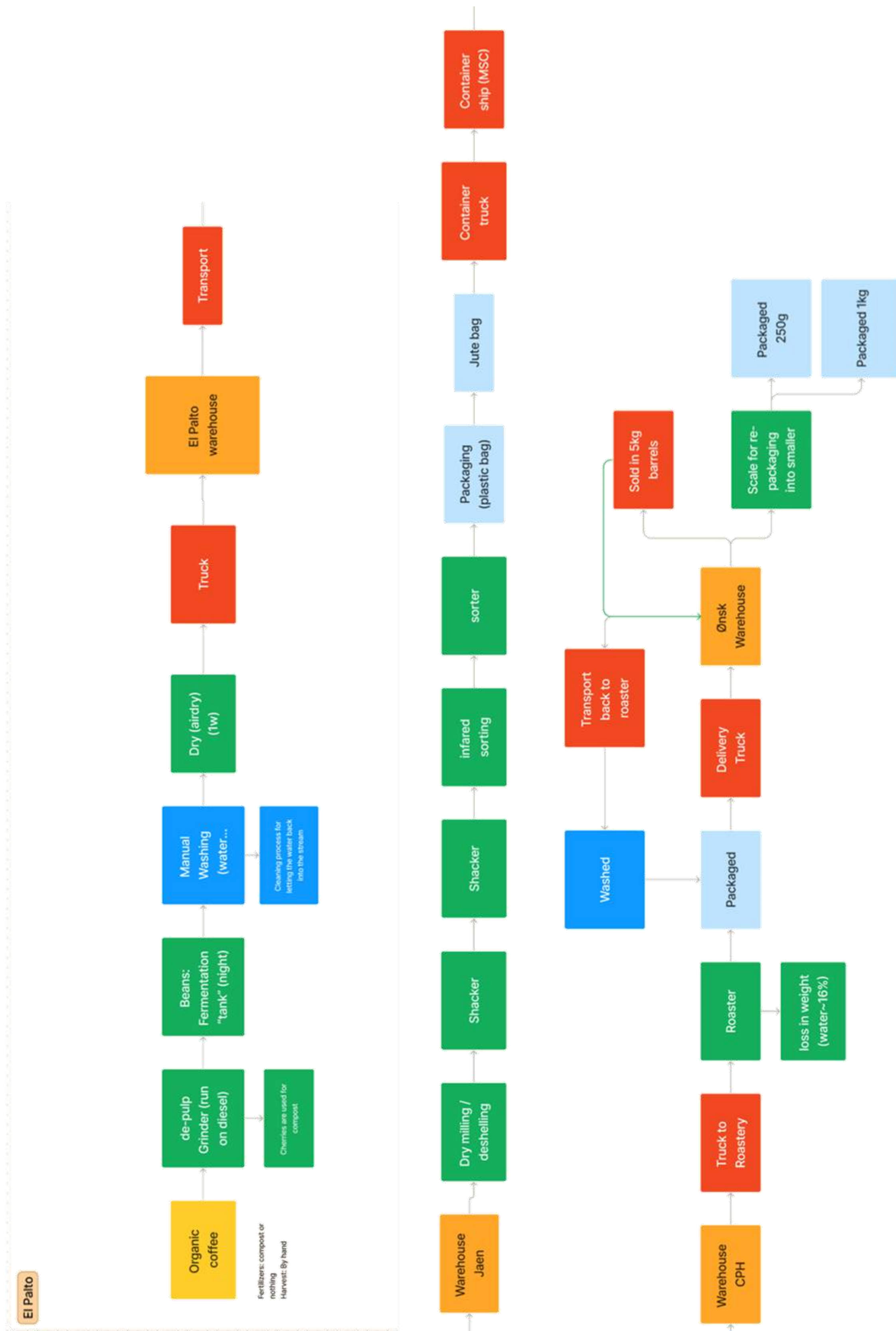


Table 1: The inventory for the Coffee, El Palto production

Country of Origin	Peru			Reference/comments
Cultivation	Coffee_modi			Normal
Farming practice	Organic			Primary data from Ønsk
Yield	Database yield	1,340.00	kg/ha	Process from Ecoinvent v3.9
	Total harvest	301.005	ton	Primary data from Ønsk
	Cultivated area	161.5	ha	
	Yield	1,863.808	kg/ha	
Land Use Change (LUC)	LUC within the last 20 years	None		Primary data from Ønsk
Inputs	market for compost	2,000.00	kg/ha	Primary data from Ønsk
	N from compost	22.85	kg/ha	
	P from compost	44.84	kg/ha	
	K from compost	52.92	kg/ha	
	Bird-derived fertilizer	500.00	kg/ha	Nutrient content information from: GUANO DE LAS ISLAS
	N from compost	60.00	kg/ha	
	P from compost	55.00	kg/ha	
	K from compost	12.50	kg/ha	
	Compost, of manure and agro-industrial residues (for organic fertilizer)	800.00	kg/ha	Primary data from Ønsk
	Biowaste, shredded	-	kg/ha	
	Green waste and straw, shredded	-	kg/ha	
	Coffee Mucilage Foliar	2.00	L/ha	
	Coffee Mucilage Foliar	42.00	L/ha	

Activity (Product)				Reference/comments
De-pulp Grinder	Manufacturer	Eterna y Estrella (Colombia)		Primary data from Ønsk
	Processing time	N/A		
	Capacity (wet Parchment Coffee)	331	kg/hr	
	Input (Cherry Coffee)	331	kg/hr	
	Output (wet Parchment Coffee)	165	kg/hr	
Manual Washing	Water consumption	120	L/kg	Primary data from Ønsk
Questions to calculate the impact of their diesel consumption (Parchment Coffee)	Processed amount of coffee (parchment)	2,070.00	kg/ha	Primary data from Ønsk
	Petrol combustion	0.5	lts/hr	Primary data from Ønsk
	Packaging film	0.2268	kg/pk	Primary data from Ønsk

Transport to Ecotierra Coffee (Normal)

Activity (Product)				Reference/comments
From Grower to El Palto	Transport type	light commercial vehicle		Primary data from Ønsk
	Proportion %	100%		

	Fuel for transport	Gasoline		
	Travelled distance	5.00	km	
	Transport type	light commercial vehicle		
	Proportion %	100%		
	Fuel for transport	Gasoline		
	Travelled distance	15.00	km	

Ecotierra Coffee

Activity (Product)		Amount	Unit	Reference/comments
Pozo de Alimentacion	Manufacturer			*Primary data from Ønsk*
	Model number			
	Capacity	28,200.00	kg/hr	
	Input	3,500.00	kg	
	Output	3,500.00	kg	
	Heat		MJ per kg/hr	
	Energy consumption		kWh	
Elevator 1	Manufacturer	-	2,24 kW	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	12,500.00	kg/hr	
	Input	28,200.00	kg	
	Output	28,200.00	kg	
	Heat	-	MJ per kg/hr	
	Energy consumption	1.50	kWh	
Tolva Pergamino	Manufacturer	-	3,73 kW	*Primary data from Ønsk*
	Model number		horas	
	Capacity	12,500.00	kg/hr	
	Input	18,500.00	kg	
	Output	18,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	-	kWh	
Elevator 2	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	12,500.00	kg/hr	
	Input	28,200.00	kg	
	Output	28,200.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	1.00	kWh	
Pre Cleaner	Manufacturer	-	0	*Primary data from Ønsk*
	Model number		horas	
	Capacity	14,000.00	kg/hr	
	Input	12,500.00	kg	
	Output	12,500.00	kg	
	Yield	100%		

Activity (Product)		Amount	Unit	Reference/comments
	Heat	-	MJ per kg/hr	
	Energy consumption	3.00	kWh	
Elevator 3	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	12,500.00	kg/hr	
	Input	28,200.00	kg	
	Output	28,200.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	-	kWh	
DESPEDREGADORA	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	Horas	
	Capacity	12,500.00	kg/hr	
	Input	28,500.00	kg	
	Output	28,500.00	kg	
	Yield	100%		
	Heat	0.0018	MJ per kg/hr	
	Energy consumption	29.04	kWh	
Fosa Café Oro Bruto	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	1.00	kg/hr	
	Input	1.00	kg	
	Output	1.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	-	kWh	
Elevator 4	Manufacturer	CIMBRIA		*Primary data from Ønsk*
	Model number	9.25	horas	
	Capacity	12,500.00	kg/hr	
	Input	28,500.00	kg	
	Output	28,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	1.20	kWh	
TRILLADORA	Manufacturer	0.10	0,07 kW	*Primary data from Ønsk*
	Model number	5.78	horas	
	Capacity	5,890.00	kg/hr	
	Input	34,049.00	kg	
	Output	34,049.00	kg	
	Yield	100%		
	Heat	0.0268	MJ per kg/hr	
	Energy consumption	105.80	kWh	
Screener	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	12,500.00	kg/hr	
	Input	7,500.00	kg	
	Output	7,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
Elevator 5	Manufacturer	3.00	2,24 kW	*Primary data from Ønsk*
	Model number	1.00	horas	
	Capacity	34,049.00	kg/hr	

Activity (Product)		Amount	Unit	Reference/comments
	Input	34,049.00	kg	
	Output	29,440.00	kg	
	Yield	86%		
	Heat	-	MJ per kg/hr	
	Energy consumption	2.24	kWh	
Elevator 6	Manufacturer	2.20	1,64 kW	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	2,500.00	kg/hr	
	Input	2,500.00	kg	
	Output	2,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	1.10	kWh	
SELECTORA - TAMAÑO	Manufacturer	-	2,24 kW	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	414.00	kg/hr	
	Input	34,049.00	kg	
	Output	34,049.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	6.14	kWh	
Elevator 7	Manufacturer	SOBRE MAYA 17		*Primary data from Ønsk*
	Model number	7.40	horas	
	Capacity	4,600.00	kg/hr	
	Input	9,500.00	kg	
	Output	9,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	1.10	kWh	
Elevator 8	Manufacturer	2.20	1,64 kW	*Primary data from Ønsk*
	Model number	9.24	horas	
	Capacity	12,500.00	kg/hr	
	Input	9,500.00	kg	
	Output	9,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
Storage Hopper 2	Manufacturer	0.10	0,07 kW	*Primary data from Ønsk*
	Model number	6.16	horas	
	Capacity	5,520.00	kg/hr	
	Input	33,987.00	kg	
	Output	33,987.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	-	kWh	
Elevator 9	Manufacturer	CIMBRIA	2,24 kW	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	12,500.00	kg/hr	
	Input	9,500.00	kg	
	Output	9,500.00	kg	

Activity (Product)		Amount	Unit	Reference/comments
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
DESIMETRICA	Manufacturer	1.20	0,90 kW	*Primary data from Ønsk*
	Model number	7.39	horas	
	Capacity	7,200.00	kg/hr	
	Input	7,200.00	kg	
	Output	7,200.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	8.60	kWh	
DESIMETRICA	Model number		horas	*Primary data from Ønsk*
	Capacity	7,200.00	kg/hr	
	Input	7,200.00	kg	
	Output	7,200.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	8.60	kWh	
DESIMETRICA	Manufacturer			*Primary data from Ønsk*
	Model number		horas	
	Capacity	7,200.00	kg/hr	
	Input	7,200.00	kg	
	Output	7,200.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	9.50	kWh	
DESIMETRICA	Manufacturer	0.10	0,07 kW	*Primary data from Ønsk*
	Model number	6.16	horas	
	Capacity	3,500.00	kg/hr	
	Input	3,500.00	kg	
	Output	3,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	5.00	kWh	
DESIMETRICA	Manufacturer	CIMBRIA	2,24 kW	*Primary data from Ønsk*
	Model number	GA 31		
	Capacity	2,500.00	kg/hr	
	Input	2,500.00	kg	
	Output	2,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	8.00	kWh	
ELEVATOR 10	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	7,500.00	kg/hr	
	Input	4,500.00	kg	
	Output	4,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
ELEVATOR 11	Model number	-	horas	*Primary data from Ønsk*
	Capacity	7,500.00	kg/hr	
	Input	4,500.00	kg	

Activity (Product)		Amount	Unit	Reference/comments
	Output	4,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
ELEVATOR 12	Manufacturer	-	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	34,049.00	kg/hr	
	Input	4,500.00	kg	
	Output	4,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
ELEVATOR 13	Manufacturer	CIMBRIA	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	7,500.00	kg/hr	
	Input	4,500.00	kg	
	Output	4,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	0.75	kWh	
ELEVATOR 14	Manufacturer	CIMBRIA	0	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	7,500.00	kg/hr	
	Input	4,500.00	kg	
	Output	4,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	1.00	kWh	
ELECTRONICA	Manufacturer	1.20	0,90 kW	*Primary data from Ønsk*
	Model number	7.39	horas	
	Capacity	12,500.00	kg/hr	
	Input	18,500.00	kg	
	Output	18,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	4.50	kWh	
ELEVATOR 15	Model number	-	horas	*Primary data from Ønsk*
	Capacity	12,500.00	kg/hr	
	Input	18,500.00	kg	
	Output	18,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	1.00	kWh	
ELECTRONICA	Manufacturer		1,64 kW	*Primary data from Ønsk*
	Model number	SATAKE	horas	
	Capacity	8,500.00	kg/hr	
	Input	18,500.00	kg	
	Output	18,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	16.57	kWh	
ELEVATOR 16	Manufacturer	0.10	0,07 kW	*Primary data from Ønsk*
	Model number	6.16	horas	

Activity (Product)		Amount	Unit	Reference/comments
	Capacity	5,520.00	kg/hr	
	Input	33,987.00	kg	
	Output	33,987.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	-	kWh	
TOLVA EXPORTABLE	Manufacturer	CIMBRIA	2,24 kW	*Primary data from Ønsk*
	Model number	-	horas	
	Capacity	12,500.00	kg/hr	
	Input	18,500.00	kg	
	Output	18,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	-	kWh	
BASCULA	Manufacturer	1.20	0,90 kW	*Primary data from Ønsk*
	Model number	7.39	horas	
	Capacity	8,500.00	kg/hr	
	Input	18,500.00	kg	
	Output	18,500.00	kg	
	Yield	100%		
	Heat	-	MJ per kg/hr	
	Energy consumption	5.50	kWh	

Packaging material

Activity (Product)		Amount	Unit	Reference/comments
Packaging material 1	Packaging material	Jute		*Primary data from Ønsk*
	Content weight	69	kg	
	Packaging weight	0.429	kg/pk	
Packaging material 2	Packaging material	Packaging film		
	Content weight	69	kg	
	Packaging weight	0.161	kg/pk	

Transport

Activity (Product)		Amount	Unit	Reference/comments
From *El Cruze* to *Warehouse Jaen*	Transport type	16-32 metric ton, EURO6, RoW		*Primary data from Ønsk*
	Fuel for transport	Gasoline and Diesel		
	Travelled distance	85.00	km	

Warehouse

Activity (Product)		Amount	Unit	Reference/comments
Warehouse Jaen	Address	CAFÉ SELVA NORTE		*Primary data from Ønsk*
	Time designated	8,640	Hours	
	Storage temperature	ambient	°C	
	Energy consumption	20.8	kWh	

	Warehouse dimension	12,600	m3	
	Total handled amount	850,000	kg	
	Volume per bag	0.175	m^3 per bag	
	Number of bags	600	bags	
	Day(s)	365	days/yr	
	Warehouse size	105	m^3	

Transport

Activity (Product)		Amount	Unit	Reference/comments
To the port	Transport type	16-32 metric ton, EURO6, RoW		*Primary data from Ønsk*
	Adress From	Jaen warehouse		
	Adress To	Paita, Peru		
	Fuel for transport	Diesel		
	Travelled distance	439.00	km	
Port to Denmark	Transport type	Container ship		*Primary data from Ønsk Distance calculated from http://ports.com/sea-route/*
	Traveled distance	8499	nm	
		15740.148	km	

Activity (Product)		Amount	Unit	Reference/comments
Truck to Roastery	Transport type	Road		Primary data from Ønsk
	Truck size	EURO6, 16-32 MT		
	Fuel for transport	Diesel		
	Transport condition	ambient	ambient/chilled	
	Travelled distance	20.3	km	
Machine: Roaster	Manufacturer	Loring		Primary data from Ønsk
	Processing time	S70 Perigrine		
	Capacity	276	kg/hr	
	Input	69	kg	
	Output	57.670	kg	
	Yield	83.58%		
	Heat	2.3	MJ per kg/hr	
Packaging material	Packaging material	HDPE		Primary data from Ønsk
	Content weight	5	kg	
	Packaging weight (drum, reused)	1.005	kg/pk	
Barrel washing	Water	1.10	L/barrel	Primary data from Ønsk
	Detergent type	liq. detergent		
	Detergent consumption	N/A	L/barrel	
Truck back to Roastery (empty barrels)	Transport type	Road		Primary data from Ønsk
	Truck size	EURO6, 16-32 MT		
	Fuel for transport	Diesel		
	Transport condition	ambient		
	Travelled distance	12.7	km	
Truck to Ønsk Warehouse	Transport type	Road		Primary data from Ønsk
	Truck size	EURO6, 16-32 MT		
	Fuel for transport	Diesel		
	Transport condition	ambient		
	Travelled distance	12.7	km	
Packaging material (250 g bag)	Packaging material	PLA		Primary data from Ønsk
	Content weight	0.25	kg	
	Packaging weight	0.0135	kg/pk	
Packaging material (1 kg bag)	Packaging material	PLA		Primary data from Ønsk
	Content weight	1	kg	
	Packaging weight	0.031	kg/pk	
Packaging machine (250 g bag)	Manufacturer	Kina		Primary data from Ønsk
	Processing time	HA-ACZ-C		
	Capacity	654.5	pk/hr	
	Energy	0.8	kWh	
	Energy consumption	0.001222222	kWh/pk	
	Manufacturer	Kina		Primary data from Ønsk

Activity (Product)		**Amount**	**Unit**	**Reference/comments**
Packaging machine (for 1 kg bag)	Processing time	HA-ACZ-C		
	Capacity	411.4	pk/hr	
	Energy consumption	0.8	kWh	
	Energy consumption	0.001944444	kWh/pk	
Packaging machine loader	Manufacturer	N/A		Primary data from Ønsk
	Processing time	N/A		
	Capacity	514.2857143	kg/hr	
	Energy consumption	1.1	kWh	
	Energy consumption	0.00213889	kWh/kg	

Results

Given below are the primary results derived from the LCA performed for 250 g, 1 kg, and 5 kg of packaged coffee produced at for global warming potential calculated using the EF 3.0 method (which uses the IPCC methodology).

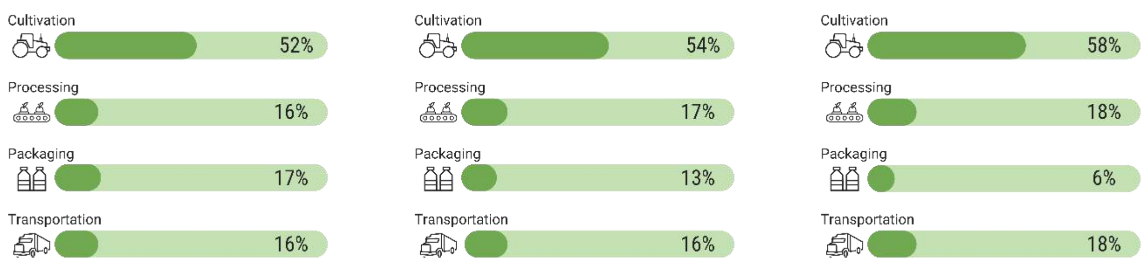
Table 2. Carbon footprint result of the products

Product	Packaging size	$kgCO_2eq/kg$	$kgCO_2eq/unit$
Ønsk coffee, El Palto	0.25 kg	1.635	0.409
Ønsk coffee, El Palto	1 kg	1.558	1.558
Ønsk coffee, El Palto	5 kg	1.455	7.273

Each 0.25 kg, 1 kg, and 5 kg package of Ønsk coffee contributes to approximately 0.409 kg, 1.558 kg, and 7.273 kg of CO_2eq, respectively, which is equivalent to 1.635 $kgCO_2eq$, 1.558 $kgCO_2eq$, and 1.455 $kgCO_2eq$ per 1 kg of coffee.

When broken down into four groups, namely *Cultivation*, *Processing*, *Packaging*, and *Transportation*, the contribution from each group is shown in **Figure 2**. The step-by-step carbon footprint accumulation is shown in **Table 3**. The main difference among the products is from the packaging, since the smaller packaging unit requires more packaging materials.

Figure 2. Emission contribution% from the supply chain



Ønsk coffee, El Palto, 0.25 kg   Ønsk coffee, El Palto, 1 kg   Ønsk coffee, El Palto, 5 kg

Table 3. Carbon footprint aggregation along the supply chain

Supply chain steps	0.25 kg	1 kg	5 kg
Cultivation	0.60902	0.60902	0.60902
Cultivation processing	0.01408	0.01408	0.01408
Transport	0.03924	0.03924	0.03924
At Plant: Dehulling	0.19705	0.19705	0.19705
Transport truck	0.01448	0.01448	0.01448
Warehouse	0.00050	0.00050	0.00050
Transport Truck	0.07479	0.07479	0.07479
Transport Ship	0.07309	0.07309	0.07309
Transport Truck	0.00524	0.00524	0.00524
Roaster	0.35772	0.35772	0.35772
Barrel Washing	0.06647	0.06647	0.06647
Transport to Ønsk	0.00248	0.00248	0.00248
Transport Empty barrels	0.00042	0.00042	0.00042
Ønsk re-packaging	0.00200	0.00116	-
packaging material	0.17818	0.10229	-
Total	**1.63476**	**1.55804**	**1.45459**